Memorandum

To: Eric Blischke and Chip Humphrey, EPA Region 10

From: Lower Willamette Group

CC:

Date: February 18, 2009

Re: Summary of Large Feasibility Study Examples and Discussion of Pros and Cons as Examples for Portland Harbor

---

The purpose of this memorandum is to summarize the approach used to create feasibility studies (FS) for a number of larger contaminated sediment sites and determine where these provide good and bad examples of potential FS approaches for Portland Harbor. EPA has requested such examples, and this memorandum is intended to provide supporting analysis of those examples.

This effort focused on three FSs that the LWG believes are relatively good examples of general approaches for large contaminated sediment sites. They include FSs completed for Onondaga Lake in Syracuse, New York; for Bellingham Bay in Bellingham, Washington; and for the Fox River in Green Bay, Wisconsin. For each FS we provide a short background on the project, the steps followed with the FS, and our analysis of "pros" and "cons" for each based on how such an approach might be applied to Portland Harbor.

KEY LWG FS APPROACHES

Before discussing the specific examples, it is useful to provide some context for why LWG views certain aspects of these example FSs as either pros or cons. Pros are generally consistent with nine key LWG FS approaches and cons are generally inconsistent with these approaches. The nine key LWG FS approaches are:

1. **Streamlined FS Schedule** – Develop early Preliminary Remediation Goals (PRGs) that are expected to be generally consistent with the final findings of the Risk Assessments (RA) to jump start the FS process and expedite the schedule. Reviews with EPA will be less formal and more in the form of "check ins".

611153

2. **Remedial Action Objectives (RAOs) that Relate Clearly to a Sediment Remedy** – The RAOs and resulting PRGs will be clearly linked to the findings of the RA and sediment remedies that are the subject of the FS (as opposed to water or source remediation, which are not the subjects of the FS).
3. **Risk Reduction/Risk Management** – Because of the wide range of PRGs and some very low levels, the remedy and selection of eventual Remedial Goals (RGs) must be conducted in the context of risk reduction and risk management, not absolute risk. Risk management should focus on the relative long-term outcomes of remedies and the relative cost effectiveness of achieving additional increments of risk reduction.
4. **Background Levels** – To assist in Risk Management, realistic and comprehensive background levels that use multiple lines of evidence are needed. Consistent with guidance, PRGs should not be set below anthropogenic background levels.
5. **Logistically Manageable FS Format and Evaluation Structure** – Use screening approaches and Sediment Management Areas (SMAs) to reduce the number of detailed evaluation permutations. Focus on a limited set of comprehensive alternatives that represent a range of cleanup approaches, and avoid the unwieldy process of a "mini-FS" for each SMA.
6. **Consistent Evaluation of Technologies** – To provide an objective and useful FS, remedial technologies need to be evaluated against a clear and consistent set of measures representing each of the CERCLA FS criteria. Cost estimates and feasibility evaluations should include the same factors for all technologies. Effectiveness evaluations should use the same endpoints for all technologies that are a direct outgrowth of the RAOs and PRGs.
7. **Present LWG Recommended Alternative and RGs** – The FS will include a LWG recommended alternative and RGs that relate to an appropriate balance of risk reduction and cost to assist EPA in final alternative selection.
8. **Flexibility in Recommended Alternative** – The LWG recommended alternative will allow for flexibility at the Remedial Design stage for variations in the applications of technologies that are equally protective in particular areas or subareas. Performance standards will be presented for each technology to facilitate determining that the alternative technology is protective.
9. **Focused Source Control/Recontamination Evaluations** – Source control effectiveness is not an evaluation criterion for the effectiveness of sediment remedies, and source control is not a goal of the sediment remedies. The purpose of the FS source control evaluation is to describe

the status of source controls and determine whether sediment recontamination is likely to occur in the absence of additional source controls.

ONONDAGA LAKE

Background

Onondaga Lake is a 4.6-square-mile lake located just northwest of the city of Syracuse in central New York State. Primary chemicals of concern for sediments include: mercury and other metals; BTEX; chlorinated benzenes; PAHs; PCBs; and PCDD/PCDFs. Water quality was also impacted by some contaminants as well as nutrient-related stressors. The project is a CERCLA site with a state lead. New York State Department of Environmental Conservations (NYSDEC) is the lead oversight agency. The responsible party prepared the FS.

FS Organization

The Onondaga Lake FS was completed using the following organization and approach:

- **Development of Preliminary Remediation Goals (PRGs)**. This task developed 8 sediment management areas (SMAs) for the lake based on common chemical, physical and biological properties. Remedial action objectives (RAOs) developed in the RI were addressed in the FS. The five RAOs were general in nature: e.g., "to eliminate or reduce, to the extent practicable, releases of mercury from profundal sediments." Three PRGs were then developed to address the five RAOs. The PRGs were qualitative in nature and purposely avoided being quantitative. They were:
  1) reduce, contain, or control contaminants of concern in sediments by achieving applicable and appropriate sediment effect concentrations, to the extent practicable;
  2) achieve contaminants of concern concentrations in fish tissue that are protective of humans and wildlife that consume fish, to the extent practicable;
  3) achieve surface water quality standards, to the extent practicable, associated with the contaminants of concern.

  Finally, methods for determining the extent of potential remediation were developed for the three PRGs. A mean PEC quotient (PECQ) was used to provide a consistent basis for classifying sediment quality and accounts for chemical additivity. Sediments having mean PECQs greater than 1 to 2 were identified as posing potential ecological risks with respect to sediment toxicity and were therefore used to define areas and volumes of impacted sediment.

- **Identification and Screening of Remedial Technologies**. Remedial technologies were developed for each general response action (GRA). These technologies were then screened. Each technology was evaluated to determine which are viable for the different SMUs given site conditions.

- **Development and Detailed Evaluation of Remedial Alternatives**. Remedial alternatives were developed and screened for each of the 8 SMUs. Five main remedial alternatives were developed for each SMU ranging from no action, to capping, to partial removal and capping, to full removal. Depending on the SMU, some of these alternatives then had sub-alternatives (e.g., different cap thicknesses). Each alternative was then evaluated against the CERCLA threshold and primary balancing criteria.

- **Development and Evaluation of Lake-Wide Alternatives**. Based on the evaluation of SMU-specific alternatives, lake-wide alternatives were developed and screened. Eleven lake-wide alternatives were developed and evaluated against the CERCLA criteria. The lake-wide alternatives had comprehensive “themes”, such as cap, habitat creation, dredge and cap, etc. A lake-wide remedial alternative was then recommended based on the evaluation process.

The FS also included a number of detailed evaluations that were included as appendices to the document.

Pros and Cons of Example – Numbers after each pro and con relate to the nine key FS approaches noted above.

Pros:

- The development of the PRGs in a qualitative versus a quantitative manner provided more flexibility in FS development (**3, 8**)
- The SMA approach of using site factors (e.g., physical factors, land use and navigation, natural resources, and contaminant distribution) provided a good means to assess realistic sediment management. This is the LWG proposed approach for Portland Harbor. (**5**)
- Screening of technologies for applicability to any SMA was effective and practical. This is the LWG proposed approach for Portland Harbor. (**5**)
- Development of site-wide alternatives that evaluate the range of alternative, but not every permutation, was effective and practical. This is the LWG proposed approach for Portland Harbor. (**5**)

Cons:

- The use standard PEC values is not directly related to site-specific risk-based PRGs. (**2, 3**)
- The evaluation of alternatives on an SMA-by-SMA basis was possible for this site, but cumbersome for 8 SMAs. It would be essentially infeasible for Portland Harbor given that over 20 SMAs are expected. The value of this SMA-by-SMA evaluation section to the overall decision process for this site was unclear. (**5**)
- The surface water RAO is not clearly achievable with a sediment remedy. (**2**)

WHATCOM WATERWAY

Background

The site is located within Bellingham Bay near Bellingham, Washington. The site is roughly one square mile in size. The contaminants of concern are mercury and phenolic compounds associated with wood handling and pulp industry. The project is being addressed under Washington State's Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS). The Washington State Department of Ecology is the lead agency. The responsible party prepared the FS.

FS Organization

The Whatcom Waterway FS was completed using the following organization and approach:

- **Cleanup Requirements.** Consistent with MTCA and SMS requirements, RAOs were developed following cleanup standards based on MTCA and SMS requirements.

- **Sediment Management Unit Development**. Using physical factors, land use and navigation, natural resources, and contaminant distribution, the site was broken into eight major SMUs and 19 sub-SMUs (synonymous with SMA).

- **Identification and Screening of Remedial Technologies**. Remedial technologies were developed and then screened. Each technology was evaluated to determine which were appropriate for Whatcom Waterway site as a whole and not evaluated for the different SMUs.

- **Development of Alternatives and Detailed Evaluation**. Eight alternatives were developed progressing from an alternative that uses the least amount of active remedial technologies to an alternative with an expanded range of dredging and upland disposal. The eight alternatives were then evaluated using MTCA and SMS criteria (which are similar in nature to the CERCLA criteria).

Pros and Cons of Example

Pros:

- Alternatives were developed site-wide progressing from alternatives having less active remedial technologies to alternatives comprised of more active technologies. This is the LWG proposed approach for Portland Harbor (**5**).
- Alternatives covered a range of permutations but not every possible combination by SMA. This is the LWG proposed approach for Portland Harbor. (**5**)
- The SMA approach of using site factors provided a good means to assess realistic sediment management. This is the LWG proposed approach for Portland Harbor. (**5**)

Cons:

- Technologies were screened on a site-wide basis instead of by SMU. Although effective for this project, we believe the variation of SMAs at Portland Harbor necessitate some discussion of how technologies might screen on an SMA basis. (**5**)
- Breaking the site into subSMAs helped identify variations to technology application within each SMAs and was useful for this project. The LWG intends to look at technology variations in Portland Harbor within each SMA, but would not go as far as designating these as "subSMAs". (**5**)
- PRGs were developed based on State standards, and therefore were not necessarily related to site-specific risks, although they are ARARs in the State of Washington. (**3**)

FOX RIVER

Background

The site in Wisconsin includes the Lower Fox River extending 39 miles from Lake Winnebago to the mouth of Green Bay and includes the entire 1,600 square miles of the bay. The contaminants of concern are PCBs and mercury.

The project is a CERCLA site with a state lead. Wisconsin Department of Natural Resources (WDNR) was the lead oversight agency and prepared the FS.

FS Organization

The Fox River FS was completed using the following organization and approach:

- **Remedial Action Levels.** The risk assessment derived sediment quality thresholds (SQTs) that were linked to estimated magnitudes of risk to valued receptors. The SQTs are not cleanup criteria, but were used to evaluate levels of risk and help develop FS action levels. The FS evaluated remedial alternatives, risks, duration, and costs relative to a series of potential sediment cleanup values. For all action levels, it was assumed that different levels of residual risk would remain after remediation. Natural processes would be relied upon to further decrease sediment chemical concentrations to protective levels.

- **Remedial Action Objectives.** The FS reviewed multiple community, state, federal, and private documents to identify common expectations for the Fox River and Green Bay. The RAOs were:

  1) achieve surface water quality criteria, to the extent practicable;
  2) protect humans who consume aquatic organisms;
  3) protect ecological receptors;
  4) reduce transport of COCs from the river; and
  5) minimize contaminant release during remediation.

  These RAOs were further defined into measurable metrics:

  - time to achieve state surface water criteria (RAO 1);
  - ability for recreational anglers to consume fish within 10 years of remedial action (RAO 2);
  - ability to achieve safe ecological thresholds for piscivorous birds and mammals within 30 years of remedial action (RAO 3);
  - time for loading from Fox River to Green Bay to equate to combined loading of other tributaries (RAO 4).

- **Remedial Alternatives Development.** Seven alternatives were evaluated including no action, monitored natural recovery, dredge with disposal or thermal treatment, and in-situ capping. All alternatives were designed to be completed in 10 years, in combination with natural recovery after remedy completion, with the degree of recovery dependent on the action level selected. Alternatives were established for the entire area of concern and not by smaller management units, i.e., no dredging in some parts of the river and capping in others.

- **Evaluation of Remedial Alternatives.** The projected number of years required for each alterative to consistently meet the RAOs were compared to different action levels and cost for each alternative using hydrodynamic and bioaccumulation models over a project 100-year time frame. A recommended alternative was not presented in the FS.

Pros and Cons of Example for Portland Harbor FS

Pros:

- Multiple remedial action levels (SQTs) were evaluated concurrent with the different alternatives. This approach facilitates the discussion of the remedy in terms of risk reduction, rather than absolutes of acceptable risk. This is the LWG proposed approach for Portland Harbor, whereby a range of key PRGs would be carried all the way through the FS. (**3**)
- The RAOs were evaluated (through site-wide models) in terms of time to success to meet the RAOs for the different alternatives. This also provides a useful relative (rather than absolute) basis for selecting alternatives. This is similar to currently proposed approach for Portland Harbor of comparing the refined alternatives in the detailed evaluation in terms of sediment and tissue concentration reductions over a set modeling time. (**3**)

Cons:

- Alternatives were developed and evaluated on a river-wide basis and not by smaller management units. This was not a "Con" for Fox River and makes sense for that river given the sources and spatial distributions of contamination. For Portland Harbor the sources and localized sites may be too varied and specific to allow for such an approach. (**5**)
- The surface water RAO and the fish consumption RAO are not translatable to the Portland Harbor, where upstream waters already fail these criteria and the site remedy can not eliminate upstream sources (**2**)
- The FS did not present a recommended alternative. This may have made strategic sense for Fox River, but for Portland Harbor we see the FS the appropriate place to present a workable and realistic remedy for the Site. (**7**)